INFLUENCE OF SUMMER TEMPERATURES ON BASIC ECONOMIC AND TOURISM INDICATORS OF THE MIDDLE MEDITERRANEAN

by

Darko B. VUKOVIĆ [a*], Ivana R. SIMEUNOVIĆ [b], Sergey ZALESOV [c], Anatoly A. YAMASHKIN [d], and Natalia SHPAK [e]

[a] Geographical Institute "Jovan Cvijić" of the Serbian Academy of Sciences and Arts, Belgrade, Serbia
[b] Belgrade Banking Academy, Belgrade, Serbia
[c] Ural State Forest Engineering University, Ekaterinburg, Russia
[d] Faculty of Geography, Ogarev Mordovia State University, Saransk, Russia
[e] Ural Federal University, Ekaterinburg, Russia

Original scientific paper
DOI: 10.2298/TSCI150328086V

The Middle Mediterranean is characterized by long, hot, and dry summers, significant historical and cultural values, and the warm Mediterranean sea, making it attractive for coastal tourism. Given these characteristics, the goal of our paper is to analyze the influence of summer temperatures in the region of the Middle Mediterranean on the values of underlying economic and tourism indicators. The method of simple linear correlation and regression was used. Based on the results of testing, we came to the conclusion that the temperatures in the summer months have no significant influence on selected economic and tourism indicators. Also, we conclude that social factors have the greatest influence on these indicators. The coefficients of variation are calculated in the observed period to analyze the variability of the tested values. It could not be identified a statistically significant relationship of indicators with summer temperatures.

Key words: *summer temperatures, economic and tourism indicators, Middle Mediterranean*

Introduction

Summer temperatures are of great importance, because their variability and extreme values have significant economic and social implications [1]. In the world literature, some authors argue that climate has a crucial impact on tourism [2-4] while a number of them dealt exclusively with the influence of climate on the Mediterranean [5-8].

In this paper the effects of temperatures in touristic season (May-September) on the basic economic and tourism indicators in the region of the Middle Mediterranean will be analyzed during the period 2000-2013. The Mediterranean region is situated in the area of great climatic importance because it is influenced by some of the most important mechanisms of the global climate system: the North Atlantic Oscillations, the South Asian monsoons, the Siberian high pressure system and the Southern Oscillations [9]. Its surrounding sub-basins extend from 9 °W to 42 °E and from 30 °N to 47 °N and can be divided into several sub-basins, for example, the Active Atlantic Mediterranean sub-basin (hereafter "AAM sub-basin") west of the Strait of Gibraltar

* Corresponding author; e-mail: d.vukovic@gi.sanu.ac.rs

Figure 1. The satellite image of the Middle Mediterran [11]

and the Black Sea, connected to the Aegean Sea by the Dardanelles Strait [10]. Hot and dry summers with cool, rainy winters are the main characteristics of the Mediterranean climate.

The Middle Mediterranean is to extend from 5 °E to 23 °E and from 30 °N to 47 °N (fig. 1) [11]. The research area is economically important. In the coastal zone, tourism, road transportation, and recreation are major uses. The Mediterranean part of Spain and France is among the most visited regions of the world, providing more than 2% of the gross domestic product from the international tourism, while in Greece over 10% of total employees work in the tourism industry [12]. Perry [12] stated that the coast of Italy, Greece, Cyprus, and Turkey in the summer months have become a new focus of seasonal migration from Northern Europe in terms of a large number of visitors from all social strata in the last few decades. How big the impact of summer temperatures in these regions is, according to the same author, is supported by his phrase "doughnut shaped": *If the summer becomes widely perceived as too hot, the season could become the "doughnut shaped", with peaks in spring and autumn months and a hole in high summer*. In his analysis, mentioned author even states that these areas are price-sensitive regions, indicating the influence of summer temperature on the economic and tourism indicators. During the period 2000-2013 summer temperatures in the region of the Middle Mediterranean have increased from 0.2 °C to 0.5 °C (fig. 2).

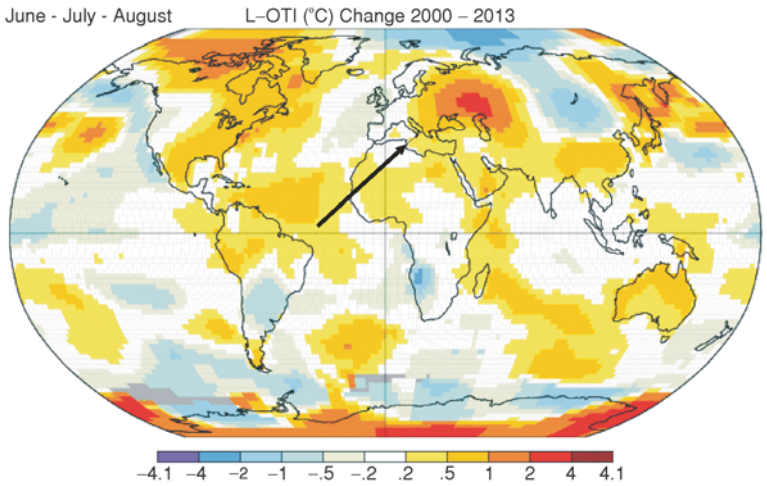

Figure 2. Trend in summer temperatures in the period 2000-2013[13]. Sources and parameters: GHCN_GISS_ERSST_1200km_Trnd0603_2000_2013 (Note: gray areas signify missing data. Ocean data are not used over land nor within 100 km of a reporting land station. The arrow points to the Middle Mediterran)

This research will be focused exclusively on the coastal regions in the Middle Mediterranean, at NUTS level 2 (Nomenclature of Territorial Units for Statistics) to evaluate the impact of summer temperatures on the coastal tourism indicators: Regional gross domestic product, Nights spent at tourist accommodation and Number of establishments and bed-places. The number of measured indicators may be higher, however, due to the volume of data and presented results of the research, we will focus only on the three most important indicators.

The defined research task, *i. e.* the analysis of this issue was carried out by setting up and testing the following hypotheses: H_0 – temperatures in the summer months do not affect the values of selected economic and tourism indicators, and H_1 – temperatures in the summer months affect the values of selected economic and tourism indicators.

Materials and methods

Since the goal of the research is to examine the impact of the existence of the selected independent variable on certain dependent ones, *i. e.* the studied variables, the method of single correlation and regression analysis was used in this paper. Having applied the regression analysis, we examined whether linear correlation exists between the studied phenomena, whereby the simple linear regression model was used:

$$Y = \beta_0 + \beta_1 \cdot X \tag{1}$$

The significance of the obtained regression relationship was tested and where Y – stands for the dependent variable, β_0 – the constant, β_1 – the slope, and X – the independent variable. On the other hand, to assess the degree of the obtained linear correlation in the selected sample, Pearson coefficient of linear correlation was used as the best known measure that expresses the degree of linear correlation between the two phenomena [14, 15]. Regression coefficients are calculated for original (B coefficients) and standardized (Beta coefficients) data.

It is necessary to provide certain explanation for the measured variables (indicators):

(1) The temperatures for period May-September were analyzed for the period 2000-2013. Temperature data were obtained from the Rimfrost website [16], which edits the NASA data. Only stations in the coastal regions were selected, in order to make the analysis as precise as possible, *i. e.* the temperatures of the region and their stations were analyzed: Ionia Nisia – Kerkyra, Malta – Luqa, Corse – Ajaccio, Puglia – Brindisi, Sardinia – Cagliari, Sicily – Messina, and Adriatic Croatia – Hvar. However, the number of weather stations is greater in these regions (fig. 3), but in order to make the analysis simpler only those located in the capitals were included in the analysis.The number of regions according to Eurostat NUTS

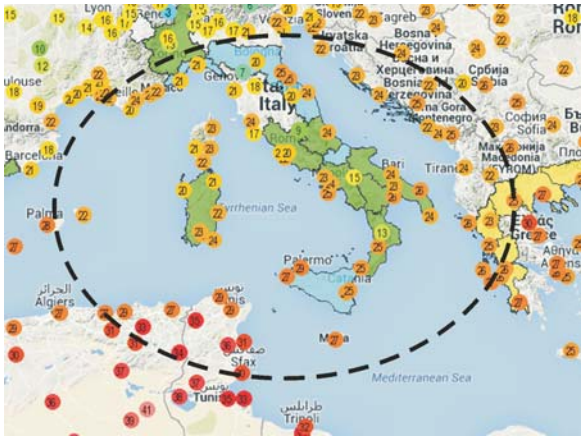

Figure 3. Average summer temperatures in period from May to September 2000-2013 in the Middle Mediterranean region [17] (note: the figure is rounded by the dashed lines where they are researched regions)

2 methodology in the Middle Mediterranean is bigger, but only those regions that have the greatest importance for coastal tourism were analyzed. In these regions is the most appropriate researching of the influence of summer temperatures on basic economic and tourism indicators. Also, in this paper there is no specific reference to the effect of the urban heat island.

(2) The main purpose of the NUTS classification of geographical areas is to provide a framework for the collection and publication of standardized statistical information, which can also be used for analysis. According to the NUTS classification, the geographical areas are divided hierarchically according to different levels: NUTS 1 is the largest territorial unit, which includes the territorial set of 3 to 7 million people. NUTS 2 has a range of 800 thousand to 3 million people and NUTS 3 has a scope of 150 to 800 thousand inhabitants [18]. This paper analyzes the regions at NUTS level 2, in order to present Eurostat data uniform for all the observed regions. This means that neither the regions situated within the Middle Mediterranean mainland nor the mountainous parts have been analyzed because they do not have greater importance for coastal tourism.

(3) Gross domestic product (GDP) is an indicator of the output of a country or a region. It reflects the total value of all goods and services produced without the value of goods and services used for intermediate consumption in their production. Expressing GDP in purchasing power standards (PPS) eliminates differences in price levels between countries. Calculations on a per inhabitant basis allow for the comparison of economies and regions significantly different in absolute size. GDP per inhabitant in PPS is the key variable for determining the eligibility of NUTS 2 regions in the framework of the European Union's structural policy.

(4) A night spent is each night a guest/tourist (resident or non-resident) actually spends (sleeps or stays) or is registered (his/her physical presence there being unnecessary) in a tourist accommodation establishment.

(5) A tourist accommodation establishment is defined as any facility that regularly or occasionally provides short-term accommodation for tourists as a paid service, although the price might be partially or fully subsidized. Data is reported at the level of a local kind-of-activity unit. The number of bed places in a tourist accommodation establishment is determined by the number of persons who can stay overnight in the beds set up in the establishment, ignoring any extra beds that may be set up upon customer request. The term bed place applies to a single bed; a double bed is counted as two bed places.

Results and discussion

Studying the linear correlation in the selected sample between the summer temperatures and the regional GDP (tab. 1), it was concluded that the t value for the regression coefficient in all the observed regions is not significant as its significance value (p value) is greater than 0.05. Testing was conducted using SPSS statistical software, as well as for tab. 2 and 3. Also, the resulting coefficients of correlation are not statistically significant at all the observed regions. Thus, it may be concluded that the summer temperatures do not significantly explain the variations in the GDP. Taking into account the articles [1, 3, 10, 14] which analyzed and determined the impact of climate and temperature on economic indicators, in the regions of the Middle Mediterranean this influence has not been found. In the regions of Puglia, Sicily, Malta and Ionia Nisia summer temperatures in the selected samples show a negative correlation with the values of GDP. The quantitative stacking is negative in this case.

Table 1. Correlation and regression analysis between summer temperatures and regional GDP, according to the analyzed regions of the Middle Mediterranean [14, 15]

Dependent variable: GDP in million EUR	Unstandardized coefficient		Standardized coefficient			Correlations	
	B	Standard error	Beta	*t*	Significance	Pearson	Significance (2-tailed)
Adriatic Croatia (Hvar)							
β_0	–5993.516	32480.858		–0.185	0.857	0.170	0.598
β_1	752.852	1381.512	0.170	0.545	0.598		
Italy (Puglia, Brindisi)							
β_0	118003.592	41978		2.811	0.018	–0.369	0.238
β_1	–2260.474	1799.787	–0.369	–1.256	0.238		
Italy (Sardegna, Cagliari)							
β_0	63150.182	4699.954		13.436	0.000	0.150	0.641
β_1	81.121	168.818	0.150	0.481	0.641		
Italy (Sicilia, Messina)							
β_0	60568.125	25524.001		2.373	0.039	–0.352	0.262
β_1	–1291.965	1086.558	–0.352	–1.189	0.262		
France (Corse, Ajaccio)							
β_0	5500.043	1898.112		2.898	0.016	0.142	0.661
β_1	37.333	82.532	0.142	0.452	0.661		
Malta (Luqa)							
β_0	7186.961	8852.902		0.812	0.440	–0.086	0.814
β_1	–87.423	359.842	–0.086	–0.243	0.814		
Greece (Kerkyra, Ionia Nisia)							
β_0	6883.791	8881.614		0.775	0.456	–0.113	0.726
β_1	–128.933	357.087	–0.113	–0.361	0.726		

Further examination of the sample (tab. 2) showed that the coefficients of correlation between the summer temperatures and nights spent at tourist accommodation were at very low levels in all regions. Only the observed sample from Malta showed the higher value of coefficient of correlation (0.755). Malta has the warmest summers among all analyzed regions of the Middle Mediterranean, but the resulting correlation is not statistically significant. Although numerous literatures consider that an increase in temperature in summer reduces the number of overnight stays, and increases them in September, forming a "doughnut shape" [12]. In the case of Malta, this theory cannot be applied. Namely, the number of overnight stays grew in the first 10 years of the 21st century [14], and subsequently declined, although the summer temperatures did not change much [15]. Specifically, the temperature did not affect the number of overnight stays, but other social factors. Most likely, the growth of tourists by 2010 was caused by the favorable economic situation that declined during and after the global economic crisis (2008-2010). This situation is evident in all geographical regions. However, this claim cannot

be completely trusted because the influence of the world economic crisis on tourism has not been analyzed.

H_1 hypothesis can be rejected in all regions at a significance level of 5%. There is no statistically significant correlation between summer temperatures and nights spent at tourist accommodation, but in some regions (Corse, Sicily, and the Adriatic Croatia), correlation is negative.

Table 2. Correlation and regression analysis between summer temperatures and nights spent at tourist accommodation according to the analyzed regions of the Middle Mediterranean [14, 15]

Dependent variable: nights spent at tourist accomondation	Unstandardized coefficient		Standardized coefficient			Correlations	
	B	Standard error	Beta	*t*	Significance	Pearson	Significance (2-tailed)
Adratic Croatia (Hvar)							
β_0	5933530.665	2911168.769		2.038	0.076	–0.307	0.477
β_1	–112550.816	123455.333	–0.307	–0.912	0.398		
Italy (Puglia, Brindisi)							
β_0	3140793.351	9362706.835		0.335	0.744	0.228	0.447
β_1	297146.889	402020.747	0.228	0.739	0.477		
Italy (Sardegna, Cagliari)							
β_0	9104078.777	991424.976		9.183	0.000	0.296	0.377
β_1	32759.041	35279.445	0.296	0.929	0.377		
Italy (Sicilia, Messina)							
β_0	9702330.927	5582205.446		1.738	0.116	–0.128	0.708
β_1	–91674.992	237401.627	–0.128	–0.386	0.708		
France (Corse, Ajaccio)							
β_0	6288316.854	2153226.183		2.920	0.015	–0.219	0.494
β_1	–66391.639	93505.026	–0.219	–0.710	0.494		
Malta (Luqa)							
β_0	–1231041.764	668309.154		–1.842	0.139	0.755	0.082
β_1	63293.356	27449.138	0.755	2.306	0.082		
Greece (Kerkyra, Ionia Nisia)							
β_0	–5010172.179	8466177.822		–0.592	0.569	0.244	0.469
β_1	256985.854	339785.500	0.244	0.756	0.469		

A similar conclusion can be drawn by testing the significance of the obtained correlation in the sample between indicators of the summer temperatures and number of establishments and bed-places (tab. 3). It was found out that the obtained *t* value for the regression coefficient is not significant. Also, the coefficients of correlation obtained in the samples were not statistically significant. This means that there was no evidence to reject the null hypothesis on the lack of dependence between the studied variables, so it is retained at a significance level of 5%.

Observed samples from the regions of Malta and Sicily showed slight negative correlation between the number of establishments and bed-places, which, however, has a negligible

impact (in the case of Sicily) or is close to zero (in the case of Malta) [14]. According to Eurostat data, the number of establishments and bed-places in the period 2000-2013 increased about 5 times in Sicily, Sardinia, and the Adriatic Croatia, while in Corse and Corfu it has increased 1.5 times, respectively. There was no impact on the increase in summer temperature on the number of establishments and bed-places in these regions, neither was there any decrease of purchasing power or greater thrift in a period of crisis. Moreover, the Croatian coastal regions and Italy were expecting growth of tourist visits, thus, they have increased their capacity regardless of the crisis. In fact, these regions encouraged by the positive trend of tourism indicators in the period before the crisis, increased capacities during the crisis, although there has been a fall in the inflow of funds from tourism and visits [14].

Table 3. Correlation and regression analysis between summer temperatures and number of establishments and bed-places according to the analyzed regions of the Middle Mediterranean [14, 15]

Dependent variable: Number of establishments and bed-places	Unstandardized coefficient		Standardized coefficient			Correlations	
	B	Standard error	Beta	*t*	Significance	Pearson	Significance (2-tailed)
Adriatic Croatia (Hvar)							
β_0	–464.072	3626.312		–0.128	0.901	0.182	0.614
β_1	80.677	153.783	0.182	0.525	0.614		
Italy (Puglia, Brindisi)							
β_0	–63.513	11612.677		–0.005	0.996	0.091	0.777
β_1	144.767	498.631	0.091	0.290	0.777		
Italy (Sardegna, Cagliari)							
β_0	2416.976	1140.152		2.120	0.063	0.220	0.516
β_1	27.419	40.572	0.220	0.676	0.516		
Italy (Sicilia, Messina)							
β_0	12745.142	9938.720		1.282	0.232	–0.318	0.341
β_1	–424.924	422.677	–0.318	–1.005	0.341		
France (Corse, Ajaccio)							
β_0	613.813	33.966		18.072	0.000	0.010	0.976
β_1	0.045	1.475	0.010	0.031	0.976		
Malta (Luqa)							
β_0	227.676	247.388		0.920	0.393	–0.078	0.855
β_1	–1.925	10.090	–0.078	–0.191	0.855		
Greece (Kerkyra, Ionia Nisia)							
β_0	757.430	605.819		1.250	0.243	0.081	0.814
β_1	5.902	24.314	0.081	0.243	0.814		

The coefficients of variation are calculated in order to analyze the variability of the tested values (tab. 4). In the observed period of 14 years obtained coefficients of variation indicate that average deviation of the summer temperatures in all regions ranging from 2.37% to 17.89% of arithmetic means. This means that during this period in each of the regions did not cause any significant deviations of summer temperatures. When are concerned economic and

tourism indicators, the analysis showed similar results with minor divergences. The coefficients of variation for regional GDP ranging from 7.17% to 23.91% and for nights spent at tourist accommodation ranging from 4.91% to 27.37% of arithmetic means. In the case of the indicator number of establishments and bed-places, calculated coefficients of variation indicate larger range, from 3.28% to 39.73% of arithmetic means. However, even in this case could not be identified a statistically significant relationship of this indicator with summertemperatures in the researched period.

Table 4. The coefficients of variation for the summer temperatures and economic and tourism indicators

	Summer temperatures	Regional GDP	Nights spent at tourist accommondation	Number of establishments and bed-places
Adriatic Croatia	0.027	0.239	0.121	0.210
Puglia	0.031	0.072	0.099	0.365
Sardegna	0.032	0.095	0.104	0.397
Sicilia	0.032	0.085	0.050	0.324
Corse	0.179	0.180	0.274	0.033
Luga	0.024	0.149	0.104	0.089
Ionia Nisia	0.024	0.172	0.473	0.051

Conclusions

The analyzed data showed that there is no statistically significant influence of summer temperatures on the economic and tourism indicators of the Middle Mediterranean. Having applied the regression and correlation analysis in order to investigate the existence of correlation between summer temperatures and GDP for each region, respectively, the authors came to the conclusion that the null hypothesis of no impact between the studied variables can maintain at the level of significance of 5%. Thus, it may be concluded that the variable summer temperatures do not significantly explain the variations in the GDP in Middle Mediterranean. The same conclusion was drawn by testing the significance of the correlation between the summer temperatures and dependent variables – the nights spent at tourist accommodation and the number of establishments and bed-places.

It has been shown that the visits in the coastal regions of the Middle Mediterranean were not greatly influenced by air temperatures in summer. In fact, temperatures in our opinion do not have a major impact on the visits of guests in this macro region. Primarily, because of the relative temperature stability of summer temperatures of each year, tourists can expect hot and dry summers, which is the main characteristic of the Middle Mediterranean. Some authors have been examining the impact of climate change on tourism [19-21], among whom there are a substantial number of those who have used the Tourism Climatic Index (TCI) devised by Mieczkowski [22] to rate climatic conditions [23]. According to our results such models will not provide adequate results in the region of the Middle Mediterranean.

Namely, the social factors have the greatest impact on the economic and tourism indicators. An average increase of 0.5 °C [13] will not have a significant impact on tourism in the Middle Mediterranean regions. Although the fall in revenue and economic uncertainty probably will. More precisely, the outburst of the economic crisis will certainly reduce regional gross domestic product and the visits of tourists in the Middle Mediterranean (according to data [14]).

Having in mind that the largest number of tourists visiting the Middle Mediterranean come from the Northern, Western, and Central Europe, the regions that were most influenced by the effects of the global economic crisis (along with the USA) in the second half of 2008, then the declining GDP in these regions and nights spent at tourist accommodation in 2009-2010 are fairly clear.

Acknowledgments

This paper is the result of the project No. 47007 funded by the Ministry for Education, Science, and Technological Development of Republic of Serbia.

References

[1] Xoplaki, E., *et al.*, Interannual Summer Air Temperature Variability over Greece and its Connection to the Large Scale Atmospheric Circulation and Mediterranean SSTs 1950-1999, *Climate Dynamics, 20* (2003), 5, pp. 537-554
[2] Roson, R., Sartori, M., Climate Change, Tourism and Water Resources in the Mediterranean: A General Equilibrium Analysis, *International Journal of Climate Change Strategies and Management, 6* (2014), 2, pp. 212-228
[3] Roson, R., van der Mensbrugghe, D., Climate Change and Economic Growth: Impacts and Interactions, *International Journal of Sustainable Economy, 4* (2012), 2, pp. 270-285
[4] Scott, D., Hall, C. M., Gossling, S., *Tourism and Climate Change*, Routledge, New York, N. Y., USA, 2012
[5] Gossling, S., *et al.*, Tourism and Water Use: Supply, Demand, and Security: an International Review, *Tourism Management, 33* (2012), 1, pp. 1-15
[6] Tapper, R., *et al.*, The Impact of the Tourism Industry on Freshwater Resources in Countries in the Caribbean, Mediterranean, North Africa and other Regions, Report to the Travel Foundation, 2011
[7] Giorgi, F., Lionello, P., Climate Change Projections for the Mediterranean Region, *Global and Planetary Change, 63* (2008), 2-3, pp. 90-104
[8] Lolis, C. J., *et al.*, Spatial Covariability of the Climatic Parameters in the Greek area, *International Journal of Climatology, 19* (1999), 1, pp. 185-196
[9] Maheras, P., *et al.*, A 40 Year Objective Climatology of Surface Cyclones in the Mediterranean Region: Spatial and Temporal Distribution, *International Journal of Climatology, 21* (2001), 1, pp. 109-130
[10] Shaltout, M., Omstedt, A., Recent Sea Surface Temperature Trends and Future Scenarios for the Mediterranean Sea, *Oceanologia, 56* (2014), 3, pp. 411-443
[11] ***, Flash Earth Map, http://www.flashearth.com/?lat=35&lon=18&z=15&r=0&src=ggl
[12] Perry, A., Impacts of Climate Change on Tourism in the Mediterranean: Adaptive Responses, FEEM Working Paper, 2000
[13] ***, NASA,
http://www.nasa.gov/
http://data.giss.nasa.gov/cgibin/gistemp/nmaps.cgi?sat=4&sst=3&type=trends&mean_gen=0603&year1=2000&year2=2013&base1=2000&base2=2013&radius=1200&pol=rob
[14] ***, Eurostat, http://epp.eurostat.ec.europa.eu
[15] Vuković, D., Responding to the Comment: Correlation Analysis of Indicators of Regional Competitiveness: The Case of the Republic of Serbia, *Economic Horizons, 16* (2014), 2, pp. 167-171
[16] ***, Rimfrost, http://www.rimfrost.no/
[17] ***, Weather Forcast and Report,
http://www.wunderground.com/wundermap/?zoom=5&type=&tl.play=0&tl.spd=2&extremes=0&fault=0&femaflood=0&fire=0&firewfas=0&fissures=0&fronts=0&hurrevac=0&hur=0&lightning=0&livesurge=0&mm=0&ndfd=0&rad=0&dir=1&dir.mode=driving&sst=0&sat=1&sat.num=1&sat.spd=25&sat.opa=87&sat.gtt1=108&sat.gtt2=108&sat.type=IR4&seismicrisk=0&svr=0&ski=0&snowfall=0&stormreports=0&tor=0&tfk=0&tsunami=0&riv=0&wxsn=0&cams=0&pix=0#
[18] Vuković, D., *et al.*, Nomenclature of Territorial Units for Statistics: Applicability in Serbia, *Journal of Geographical Institute "Jovan Cvijic" of the Serbian Academy of Sciences and Arts, 61* (2011), 2, pp. 11-24

[19] Maddison, D., In Search of Warmer Climates? The Impact of Climate Change on Flows of British Tourists, *Climatic Change, 49* (2001), 1-2, pp. 193-208
[20] Lise, W., Tol, R. S. J., Impact of Climate on Tourist Demand, *Climatic Change, 55* (2002), 4, pp. 429-49
[21] Hamilton, J. M., Climate and the Destination Choice of German Tourists, Working Paper FNU-15 (revised), Research Unit Sustainability and Global Change, Centre for Marine and Climate Research, University of Hamburg, Hamburg, Germany, 2003
[22] Mieczkowski, Z., The Tourism Climatic Index: A Method of Evaluating World Climates for Tourism, *Canadian Geographer, 29* (1985), 3, pp. 220-233
[23] Amelung, B., Viner, D., Mediterranean Tourism: Exploring the Future with the Tourism Climatic Index, *Journal of Sustainable Tourism, 14* (2006), 4, pp. 349-366

Paper submitted: March 28, 2015
Paper revised: April 16, 2015
Paper accepted: April 28, 2015